STATE OF MAINE

DEPARTMENT OF TRANSPORTATION

TRANSPORTATION RESEARCH DIVISION
BUREAU OF PLANNING, RESEARCH & COMMUNITY SERVICES

DATE

MAY 2000

STATE EXPERIMENTAL CONSTRUCTION

99-11

INNOVATIVE SOLUTIONS to BURIED PORTLAND CEMENT CONCRETE ROADWAYS

FIRST INTERIM REPORT

INTRODUCTION

Maine has hundreds of miles of highway that were constructed of Portland Cement Concrete (PCC) roughly 6 to 6.1 meters (18 to 20 feet) wide forty or more years ago. Since that time these same highways have been paved and widened to 6.7 or 7 meters (22 or 24 feet) with hot bituminous pavements to accommodate increased traffic volumes. Bituminous materials were used instead of concrete due to the ease of placement and price of material.

PCC is a rigid pavement capable of supporting weight with little deflection. Hot bituminous pavement is flexible and will bend to distribute weight across the roadway. When the highway is expanded beyond the concrete slab there is a sharp decrease of support for this bituminous pavement resulting in settlement over prolonged use. This settlement may also be compounded by poor drainage capabilities of the underlying soils causing the unsupported pavement to drop lower than the existing height of the concrete supported pavement. This creates a longitudinal crack aligning with the concrete slab edge about 0.3 to 1 meter (1 to 3 feet) from the right edge of pavement. Pavement to the right of this crack deteriorates to the point where maintenance crews attempt to smooth it out with cold patch year after year. Paving over the entire roadway is an option but, due to reflective cracking, the edge of pavement begins to deteriorate within 2 or 3 years.

It is the intent of this experimental project to explore various shoulder treatments to increase support of the extended roadway and hopefully decrease or eliminate deterioration of the shoulder pavement.

BACKGROUND

Project No. STP-8651(00)X on Route 100 between the towns of Benton and Palmyra is 30.6 kilometers (19 miles) long and scheduled for an overlay of maintenance mix. This is a 7.3 meter (24 foot) bituminous roadway over 6.2 meters (20 feet) of PCC. The 0.6 meter (2 foot) edge of pavement on both sides has deteriorated, creating a traffic hazard and maintenance problem for years. Condition of the drainage ditch is poor along the entire project and there is very little underdrain. A section of this project beginning 4.5 kilometers (2.8 miles) north of the junction of Route 100A in Benton and extending north 2.5 kilometers (1.6 miles) to the town of Clinton was selected to construct four experimental shoulder rehabilitation sections. This project was activated in August with a deadline of October 30, 1998, so time and available money to develop experimental sections was limited. An E-mail request, phone interviews, and literature search of AASHTO members were conducted to gather information on techniques used to correct composite roadway shoulder problems. A panel with personal from Highway Design, Construction, Geotechnical and the Bureau of Maintenance and Operations used this information as well as ideas of their own to design four experimental sections each 500 meters (1640 feet) in length plus a control section 500 meters (1640 feet) in length.

Another shoulder rehabilitation experiment that is not part of the Benton - Clinton project but will be included in this report was constructed in 1997-98 on Route 2 in Veazie. This is a 6.6 meter (22 foot) bituminous highway over 5.2 meters (18 feet) of PCC. This project also had poor drainage and a deteriorated pavement edge causing traffic hazards and maintenance headaches. The experimental section begins 100 meters (328 feet) north of Chase Road in Veazie and extends north 190 meters (623 feet).

CONSTRUCTION

Benton - Clinton Project No. STP-8651(00)X

Construction of each shoulder treatment went smoothly. Most of the material excavated from the shoulders consisted of granular soil not clay as expected and the depth of each trench did not penetrate the clay subgrade.

The exposed PCC slab on Sections 2 and 3 could not hold up to traffic and had to be shimmed with 9.5 millimeter (0.374 inch) bituminous mix.

Figures 1 - 4 contain cross sections for each experimental treatment. Limits and a brief description for each section is as follows:

Section 0 Maintenance Mix (control)

This section is located between station 0+500 and 1+000. There is no shoulder rehabilitation and the roadway is treated with an estimated average thickness of 2 centimeters (0.75 inches) of 9.5 millimeter (0.374 inch) maintenance mix.

Section 1 Cold Recycled Pavement

This section is located between station 1+000 and 1+500. The existing pavement was ground to slope to a nominal depth of 50 millimeters (2 inches). The shoulders were excavated adjacent to the existing PCC slab edge to a depth of 680 millimeters (27 inches) and width of 1200 millimeters (47 inches). This boxed shoulder was then filled with 300 millimeters (12 inches) of Type D Aggregate Subbase Coarse Gravel (ASCG) MDOT Standard Specifications Item Number 703.06 and 380 millimeters (15 inches) of Cold Recycled Pavement.

The roadway and shoulders were then paved with a 60 millimeter (2.4 inch) layer of 19 millimeter (0.75 inch) Superpave Binder and topped with a 40 millimeter (1.6 inch) layer of 12.5 millimeter (0.5 inch) Superpave wearing coarse.

Section 2 Flowable Fill

Flowable Concrete Fill is a concrete mixture that includes 245-105 kg cement/M^3 with a water-cement ratio not high enough to cause segregation of the mix and a target Air Content of 5-15 percent. A modified slump test spread of 225 - 350 millimeters is considered flowable. The slump spread is obtained by setting a 75 millimeter x 150 millimeter cylinder mold, open on both ends, on a flat surface, then filling the cylinder and striking off the top. During a count of three seconds, lift the cylinder straight up allowing the sample to spread on the flat surface. The spread diameter is measured to the nearest 15 millimeters (0.6 inches).

All existing pavement was removed to the PCC surface and the shoulders were excavated adjacent to the PCC slab to a depth of 530 millimeters (21 inches) and width of 1200 millimeters (47 inches).

There are two separate shoulder treatments within this section. Section 2A located between station 1+500 to 1+970 right and 1+500 to 2+000 left. This section has 300 millimeters (12 inches) of ASCG and 230 millimeters (9 inches) of Flowable Fill.

Section 2B is located between station 1+970 and 2+000 right. This section has no ASCG and 530 millimeters (21 inches) of Flowable Fill.

Surface treatment for Section 2 consists of 60 millimeters (2.4 inches) of 19 millimeter (0.75 inch) Superpave Binder and 40 millimeters (1.6 inches) of 12.5 millimeter (0.5 inch) Superpave wearing coarse.

Section 3 Superpave

This section is located between station 2+000 and 2+500. The existing pavement was removed and shoulders were excavated beside the PCC slab to a depth of 530 millimeters (21 inches) and width of 1200 millimeters (47 inches).

The shoulder treatment consists of 300 millimeters (12 inches) of ASCG and 230 millimeters (9 inches) of 25 millimeter (1 inch) Superpave Binder.

Again, the roadway and shoulders were paved with 60 millimeters (2.4 inches) of 19 millimeter (0.75 inch) Superpave Binder and 40 millimeters (1.6 inches) of 12.5 millimeter (0.5 inch) Superpave wearing coarse.

Section 4 Heavy Overlay

Section 4 is located between station 2+500 and 3+000. The existing shoulders were graded to slope and the roadway was shimmed with a minimum of 13 millimeters (0.5 inches) of 9.5 millimeter (0.374 inch) bituminous mix. Then the roadway and shoulders were paved with 40 millimeters (1.6 inches) of 12.5 millimeter (0.5 inch) Superpave wearing coarse.

Veazie - Orono Project No. STP-6683(00)X

Construction of this shoulder treatment and application of the self adhesive mesh went smoothly with no setbacks. Figure 5 contains a typical section of the self adhesive mesh.

A description and location for each section is as follows:

Self Adhesive Mesh Section

This experimental area begins at station 2+140 and ends at 2+330. The project entails grinding 75 millimeters (3.0 inches) of existing pavement then shimming with 5 millimeters (0.2 inches) of 4.75 millimeter (0.187 inch) bituminous mix.

The shoulders were trenched to a depth of 150 millimeters (6 inches) below height of the milled and shimmed pavement and to a variable width of 0.6 to 2.5 meters (2 to 8 feet). This trench is then filled with 150 millimeters (6 inches) of Hot Recycled Pavement made up of a blend of 60 percent virgin aggregate and 40 percent recycled pavement with an asphalt content of 2.5 to 4.5 percent using AC-20 grade asphalt cement. A layer of PavePrep SA7 self adhesive mesh 508 millimeters (20 inches) wide manufactured by Contech Construction Products Incorporated was placed to bridge the transition between concrete supported pavement and Hot Recycled shoulder.

The roadway and shoulders were then paved with 40 millimeters (1.5 inches) of 19 millimeter (0.75 inch) binder and 30 millimeters (1.2 inches) of 12.5 millimeter (0.5 inch) wearing coarse.

Control Section

This section is located between station 3+230 and 3+420. The existing pavement was milled to a depth of 75 millimeters (3.0 inches) then shimmed with 5 millimeters (0.2 inches) of 4.75 millimeter (0.187 inch) bituminous mix.

Shoulders were excavated to a width of 600 millimeters (22 inches) beyond the PCC edge and depth of 150 millimeters (6 inches) below the milled pavement surface. This boxed shoulder area was filled with 150 millimeters (6 inches) of Hot Recycled Pavement.

The highway and shoulders were then surfaced with 40 millimeters (1.5 inches) of 19 millimeter (0.75 inch) binder and 30 millimeters (1.2 inches) of 12.5 millimeter (0.5 inch) wearing course.

COST ANALYSIS

A cost per Section summary for the Benton - Clinton project is listed in Table 1. The Section/Meter totals for each treatment represents the cost per centerline meter from shoulder to shoulder. Please note that Section 0 and 4 shoulder treatment costs represent a 0.6 meter (2 foot) wide shoulder whereas Section 1, 2 and 3 costs are for a 1.2 meter (4 foot) shoulder.

A review of the data reveals that Section 3 Superpave had the highest cost followed by Section 2B Full Depth Flowable Fill, Section 2A 230 mm Flowable Fill, Section 1 Cold Recycled Pavement, Section 4 Heavy Overlay and finally Section 0 Maintenance Mix.

Table 2 contains a summary of costs per meter for the Veazie - Orono project. The column labeled Section/Meter represents the cost per centerline meter from shoulder to shoulder. Since the Experimental Section has a wider shoulder treatment than the Control Section, the cost analysis for this section will be based on a 0.6 meter (2 foot) shoulder.

FWD TEST RESULTS

Falling Weight Deflectometer (FWD) tests were collected on 8/11/99 on the Benton - Clinton project. Tests were collected on the experimental shoulders and on the PCC supported surface adjacent to each shoulder test. Table 3 contains average raw FWD deflections in mils recorded from sensor # 1 and percent difference in deflection between roadway and shoulder deflections. Also included in Table 3 is the percent difference from 1998 FWD data. Raw deflections from the FWD were used because of software limitations when processing data collected on composite roads containing PCC. FWD data was not collected on the Veazie - Orono project.

Section 2B Full Depth Flowable Fill produced the lowest deflections (lower deflections denote stronger highways) followed by Section 3 Superpave, Section 1 Cold Recycled Pavement, Section 2A 230 mm Flowable Fill, Section 0 Maintenance Mix and Section 4 Heavy Overlay.

VISUAL OBSERVATIONS

Table 4 contains a pavement condition summary for all sections of the Benton - Clinton and Veazie - Orono projects.

Benton - Clinton Project No. STP-8651(00)X

Section 0 Maintenance Mix (control)

This section has a considerable amount of transverse cracking.

Nearly seventy percent of this section has rutting, 65.0 % of 6 mm (0.25 in) rutting, 0.8 % of 13 mm (0.5 in) rutting and 4.0 % of 19 mm (0.75 in) rutting. The 19 mm rutting appears to be caused by a truck traveling on uncompacted mix during paving operations as can be observed in photo 1.

Reflective longitudinal cracking caused by the underlying PCC edge was detected throughout 49.5 % of this section.

Section 1 Cold Recycled Pavement

This area has one transverse crack and slight rutting, less than 6 mm (0.25 in) in depth, throughout the section.

Ninety percent of the centerline joint has raveled largely due to winter plowing (photo 2).

There is a total of 0.6 % of PCC edge related reflective cracking is this section.

Section 2A 230 mm Flowable Fill

This section has one transverse crack with slight rutting throughout.

Eighty three percent of the centerline joint has raveled due to winter plowing (photo 3).

There was no PCC edge related longitudinal cracking.

Section 2B 530 mm Flowable Fill

This section also has no PCC edge related longitudinal cracking.

Section 3 230 mm of 25 mm Superpave

This section has no transverse cracks, slight rutting and 30% of the centerline joint is raveling (photo 4).

This section was constructed differently than the other sections due to seasonal restrictions when placing surface mix. MDOT specifies that traveled way surface mix can be placed between the dates of April 15th and the Saturday following October 15th. The surface paving deadline was nearing when section 3 shoulder construction began. To avoid the deadline the binder and surface was placed on the roadway to an offset of 3 m (10 ft) left and right of centerline. Reconstruction of the shoulder began after the roadway was paved. Binder and surface mix was placed after the shoulder reconstruction was completed. This left a longitudinal joint along the entire length of this section making it difficult to evaluate. The shoulder construction longitudinal joint has separated from the roadway throughout 93.2% of this section (photo 5). A longitudinal crack caused by the PCC pavement edge is located 3.1 - 3.2 m (10.25 to 10.5 ft) right and left of centerline along 12.7% of the section (photo 6). Twenty meters of this PCC related crack in the NBL is 13 mm (0.5 in) wide and has an elevation change of 6 mm (0.25 in) as shown in photo 7.

Section 4 Heavy Overlay

Section 4 has less than one quarter the transverse cracks than section 0 with slight rutting and 85% of centerline joint ravel (photo 8).

This section has a total of 4 m (13 ft) or 0.4% of reflective PCC edge cracking less than 6 mm (0.25 in) in width.

Veazie - Orono Project No. STP-6683(00)X

This project appears very stable after two years of traffic.

Self Adhesive Mesh Section

The Self Adhesive Mesh section has a total of six transverse cracks and rutting 6 mm (0.25 in) in depth.

A total of 7.8 m (25.6 ft) or 2 % of initial longitudinal cracking caused by the underlying PCC pavement edge was observed.

Control Section

The control section has three transverse cracks and rutting 6 mm (0.25 in) in depth.

A total of 106.6 m (349.7 ft) or 28 % of initial longitudinal cracking associated with the underlying PCC edge has reflected through the pavement.

SUMMARY

Benton - Clinton Project No. STP-8651(00)X

All sections are showing signs of rutting with maintenance mix experiencing the most considerable severity.

The Full Depth Flowable Fill section is outperforming all other sections with no longitudinal PCC related cracking and very stable surface deflections. In fact the shoulder surface deflections are less than the roadway deflections. Although this section has the second highest construction cost it appears to be the best shoulder treatment from a structural point of view.

Section 3 using Superpave mix has the second lowest deflections but has the highest amount of PCC related longitudinal cracking of all sections. The unusual construction procedure for this section may be contributing to the PCC reflected cracking. Perhaps core samples will determine whether the PCC edge or the shoulder pavement joint is causing this additional longitudinal cracking.

Section 1 with recycled pavement had the third lowest deflections. This section also had very little PCC edge related cracking. This treatment is performing very well and, because of the low cost of construction, is recommended for future use as a shoulder treatment for composite roads containing PCC.

Section 2A using 230 mm of Flowable Fill had the fourth lowest deflections and no PCC edge related longitudinal cracking. This treatment is recommended as a PCC composite road shoulder treatment.

The control section, Section 0 using Maintenance Mix, had the second highest deflections and the greatest amount of PCC related edge cracking. This treatment is not recommended.

The Heavy Overlay section had the highest shoulder deflections with very little PCC related edge cracking. The pavement thickness could be restricting the formation of longitudinal edge cracks but, since there is no support under the shoulder pavement, it is believed PCC edge cracking will develop in the near future.

Veazie - Orono Project No. STP-6683(00)X

Both sections are showing signs of rutting and cracking.

The Self Adhesive Mesh is reducing the amount of PCC related longitudinal edge cracking by 26% (2% reflective cracking verses 28% reflective cracking) and is recommended for use on PCC composite roads.

These projects will continue to be evaluated on a yearly basis.

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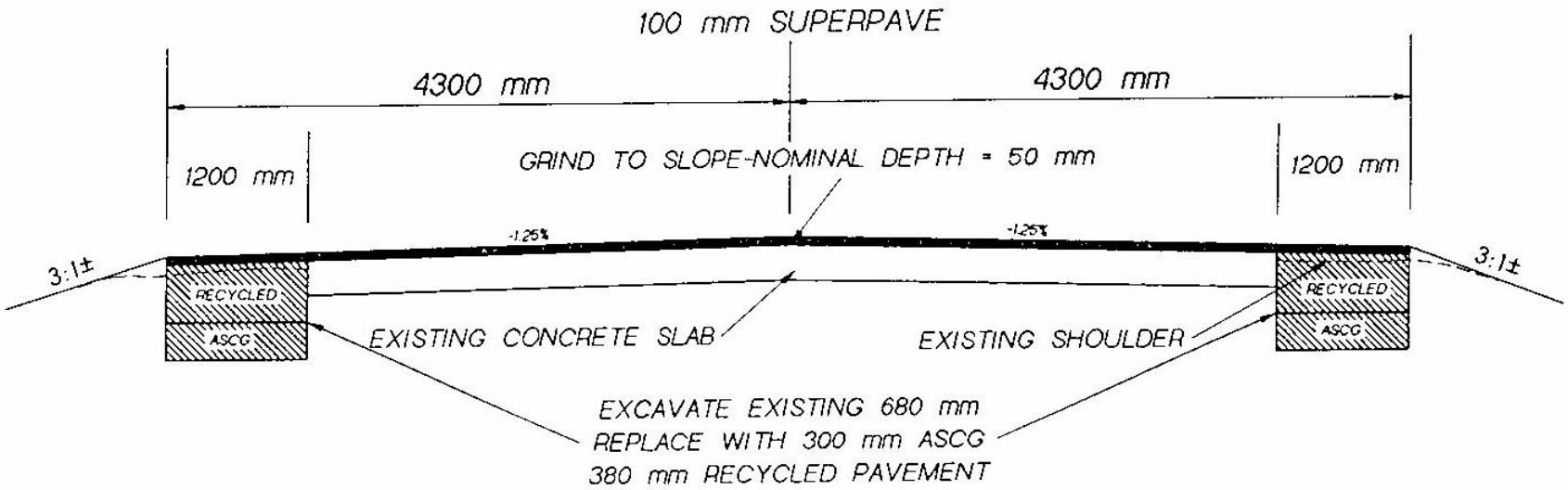
TYPICAL SECTION
RECYCLED PAVEMENT



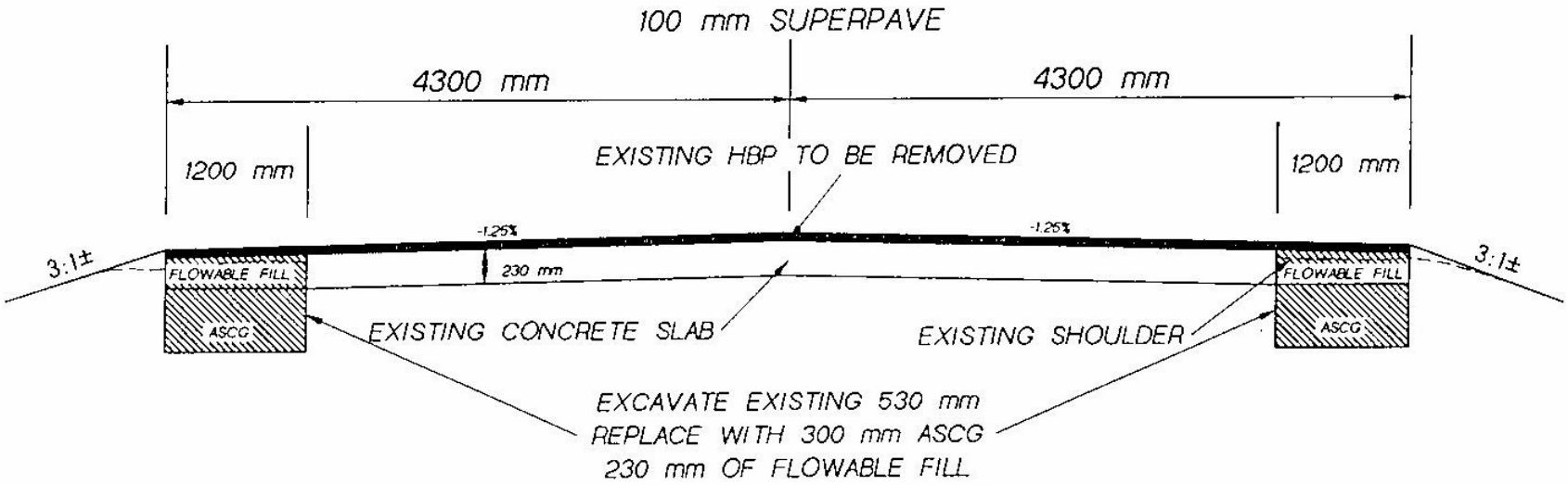
SECTION 1

STATE OF MAINE
DEPT. OF TRANSPORTATION

BENTON–CLINTON
STP–8651(00)X
ROUTE 100

Figure No. 1 Cold Recycled Pavement

TYPICAL SECTION
FLOWABLE FILL



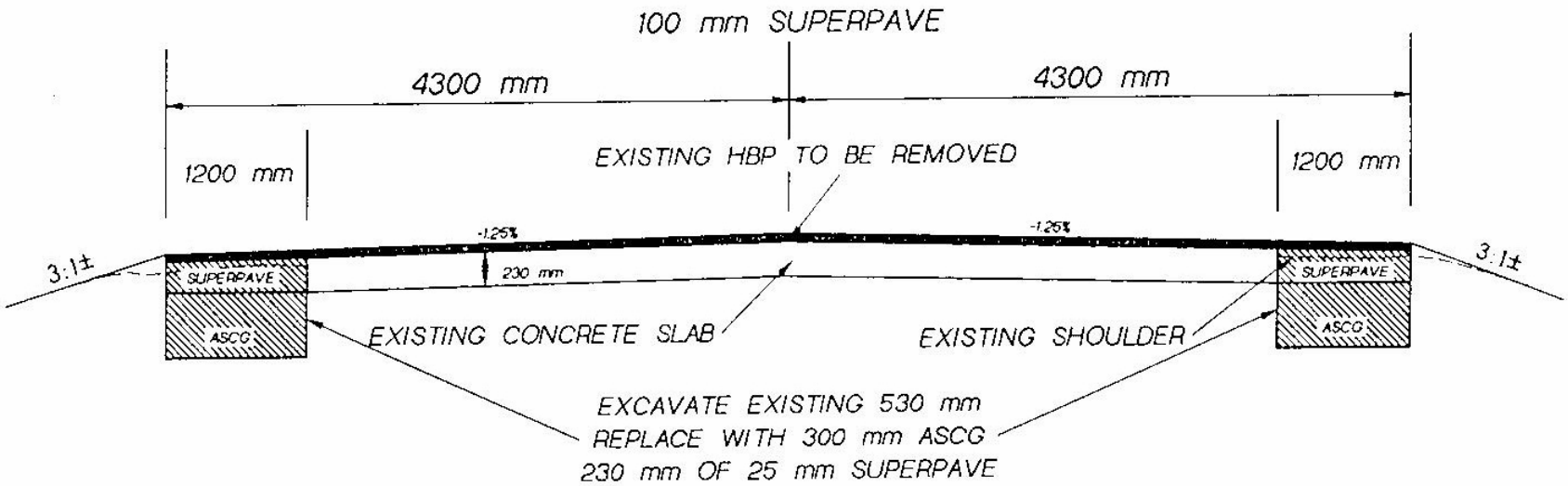
SECTION 2

STATE OF MAINE
DEPT. OF TRANSPORTATION

BENTON–CLINTON
STP–8651(00)X
ROUTE 100

Figure No. 2 Flowable Fill

TYPICAL SECTION
25 mm SUPERPAVE



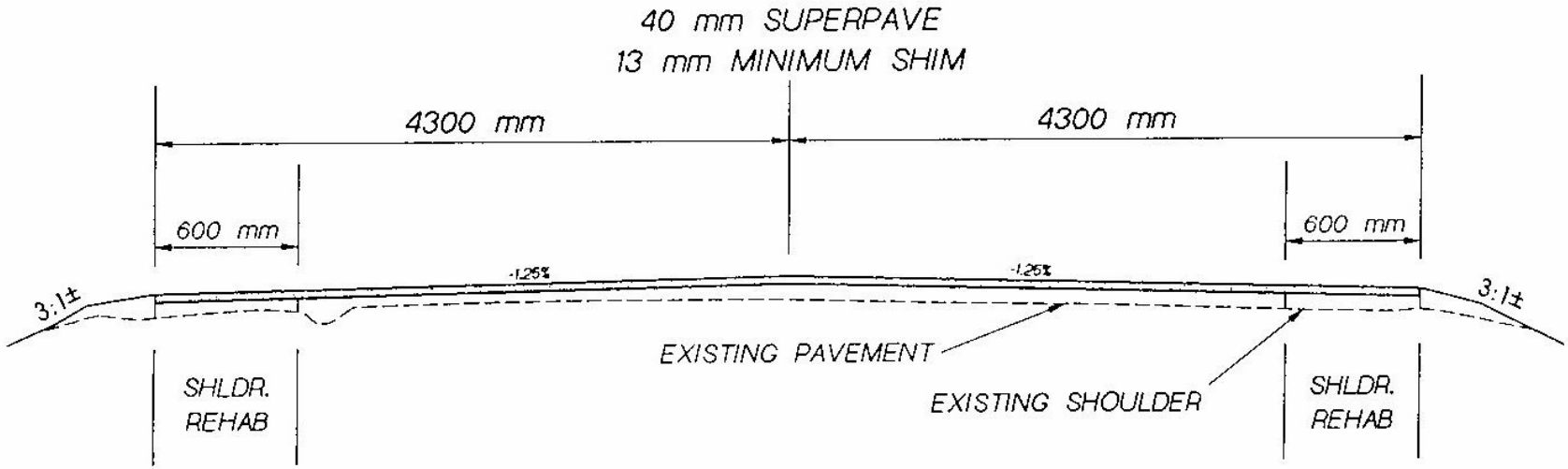
SECTION 3

STATE OF MAINE
DEPT. OF TRANSPORTATION

BENTON–CLINTON
STP–8651(00)X
ROUTE 100

Figure No. 3 Superpave

TYPICAL SECTION
HEAVY OVERLAY

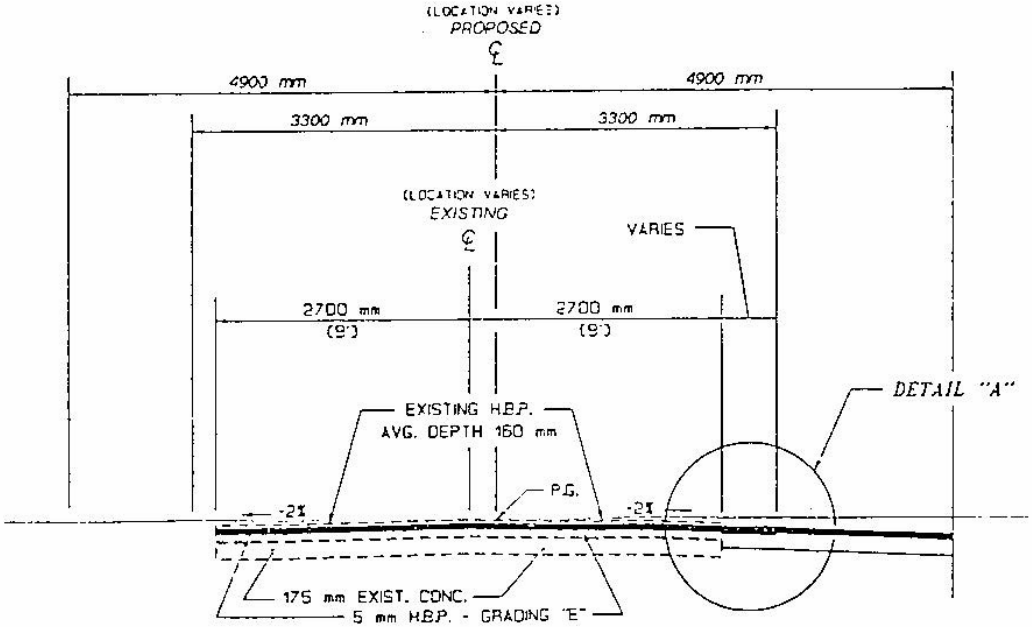


SECTION 4

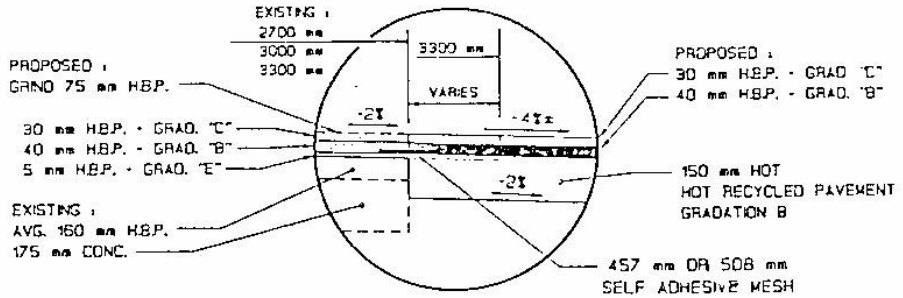
STATE OF MAINE DEPT. OF TRANSPORTATION
BENTON–CLINTON STP–8651(00)X ROUTE 100

Figure No. 4 Heavy Overlay

TYPICAL SECTION
SELF ADHESIVE MESH



STA. 2+140± TO STA. 2+330±



DETAIL "A"
(NORMAL)

STATE OF MAINE
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VEAZIE-ORONO
STP-6683(00)X
ROUTE 2

Figure No. 5 Self Adhesive Mesh

TABLE 1

BENTON - CLINTON Route 100, Project No. STP-8651(00)X, PIN 8651.00
Cost Summary
Section 0, Maintenance Mix, Station 0+500 to 1+000

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
No shoulder rehabilitation	$0.00	$0.00	$0.00
Shoulder Treatment Total:	$0.00	$0.00	$0.00
Surface Treatment			
Maintenance Mix: 500 m x 8 m x 2 cm = 189.84 Mg @ $29.02 / Mg =	$5,509.16		$11.02
Trucking costs =	$783.95		$1.57
Surface Treatment Total:	$6,293.11		$12.59
Section 0 Total:	**$6,293.11**		**$12.59**

Section 1, Cold Recycled Pavement, Station 1+000 to 1+500

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Excavation: 500 m x 2 x 1.2 m x 0.68 m = 816 m^3 @ $14.00 / m^3 =	$11,424.00	$11.42	$22.85
ASCG: 500 m x 2 x 1.2 m x 0.3 m = 360 m^3 @ $29.50 / m^3 =	$10,620.00	$10.62	$21.24
Cold Recycled Pavement: 500 m x 2 x 1.2 m x 0.38 m = 456 m^3 @ $14.25 / m^3 =	$6,498.00	$6.50	$13.00
Shoulder Treatment Total:	$28,542.00	$28.54	$57.09
Surface Treatment			
Grind pavement to slope: 500 m x 7.3 m = 3650 m^2 @ $4.00 =	$14,600.00		$29.20
19 mm Superpave: 500 m x 8.6 m x 6 cm = 612.23 Mg @ $34.25 / Mg =	$20,968.88		$41.94
12.5 mm Superpave: 500 m x 8.6 m x 4 cm = 408.16 Mg @ $34.75 / Mg =	$14,183.56		$28.37
Surface Treatment Total:	$49,752.44		$99.51
Section 1 Total:	**$78,294.44**		**$156.60**

Section 2A, 230 mm Flowable Fill, Station 1+500 to 1+970 Rt. and 1+500 to 2+000 Lt.

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Excavation: 485 m x 2 x 1.2 m x 0.53 m = 616.92 m^3 @ $14.00 / m^3 =	$8,636.88	$8.90	$17.81
ASCG: 485 m x 2 x 1.2 m x .3 m = 349.2 m^3 @ $29.50 / m^3 =	$10,301.40	$10.62	$21.24
230 mm Flowable Fill: 485 m x 2 x 1.2 m x 0.23 m = 267.72 m^3 @ $65.00 / m^3 =	$17,401.80	$17.94	$35.88
Shoulder Treatment Total:	$36,340.08	$37.46	$74.93
Surface Treatment			
Remove pavement: 485 m x 7.3 m = 3540.5 m^2 @ $4.00 =	$14,162.00		$29.20
19 mm Superpave: 485 m x 8.6 m x 6 cm = 593.87 Mg @ $34.25 / Mg =	$20,340.05		$41.94
12.5 mm Superpave: 485 m x 8.6 m x 4 cm = 395.91 Mg @ $34.75 / Mg =	$13,757.87		$28.37
Surface Treatment Total:	$48,259.92		$99.51
Section 2A Total:	**$84,600.00**		**$174.44**

Section 2B, Full Depth Flowable Fill, Station 1+970 to 2+000 Rt.

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Excavation: 15 m x 2 x 1.2 m x 0.53 m = 19.08 m^3 @ $14.00 / m^3 =	$267.12	$8.90	$17.81
ASCG:	$0.00	$0.00	$0.00
530 mm Flowable Fill: 15 m x 2 x 1.2 m x 0.53 m = 19.08 m^3 @ $65.00 / m^3 =	$1,240.02	$41.33	$82.67
Shoulder Treatment Total:	$1,507.14	$50.23	$100.48
Surface Treatment			
Remove pavement: 15 m x 7.3 m = 109.5 m^2 @ $4.00 =	$438.00		$29.20
19 mm Superpave: 15 m x 8.6 m x 6 cm = 18.37 Mg @ $34.25 / Mg =	$629.17		$41.94
12.5 mm Superpave: 15 m x 8.6 m x 4 cm = 12.24 Mg @ $34.75 / Mg =	$425.34		$28.36
Surface Treatment Total:	$1,492.51		$99.50
Section 2B Total:	**$2,999.65**		**$199.98**

Section 3, Superpave, Station 2+000 to 2+500

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Excavation: 500 m x 2 x 1.2 m x 0.53 m = 636 m^3 @ $14.00 / m^3 =	$8,904.00	$8.90	$17.81
ASCG: 500 m x 2 x 1.2 m x 0.3 m = 360 m^3 @ $29.50 / m^3 =	$10,620.00	$10.62	$21.24
25 mm Superpave: 500 m x 2 x 1.2 m x 23 cm = 654.95 Mg @ $65.00 / Mg =	$42,571.75	$42.57	$85.14
Shoulder Treatment Total:	$62,095.75	$62.09	$124.19
Surface Treatment			
Remove pavement: 500 m x 7.3 m = 3650 m^2 @ $4.00 =	$14,600.00		$29.20
19 mm Superpave: 500 m x 8.6 m x 6 cm = 612.23 Mg @ $34.25 / Mg =	$20,968.88		$41.94
12.5 mm Superpave: 500 m x 8.6 m x 4 cm = 408.16 Mg @ $34.75 / Mg =	$14,183.56		$28.37
Surface Treatment Total:	$49,752.44		$99.51
Section 3 Total:	**$111,848.19**		**$223.70**

Section 4, Heavy Overlay, Station 2+500 to 3+000

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Shoulder rehabilitation(grading): 500 m x 2 x .6 m = 600 m^2 @ $9.50 =	$5,700.00	$5.70	$11.40
Shoulder Treatment Total:	$5,700.00	$5.70	$11.40
Surface Treatment			
Superpave Shim(est.): 500 m x 7.3 m x 3 cm = 259.84 Mg @ 36.75 / Mg =	$9,549.12		$19.10
12.5 mm Superpave: 500 m x 8.6 m x 4 cm = 408.16 Mg @ $34.75 / Mg =	$14,183.56		$28.37
Surface Treatment Total:	$23,732.68		$47.47
Section 4 Total:	**$29,432.68**		**$58.87**

TABLE 2

VEAZIE - ORONO Route 2, Project No. STP-6683(00)X, PIN 6683.00
Cost Summary
Experimental Section Self Adhesive Mesh
Station 2+140 to 2+330

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Shoulder rehabilitation (ditching): 190 m x 2 x 0.6 m = 228 m² @ $3.80 =	$866.40	$2.28	$4.56
Hot Recycled Pavement: 190 m x 2 x 0.6 m x 15 cm = 81.16 Mg @ $28.00 / Mg =	$2,272.48	$5.98	$11.96
Self Adhesive Mesh: 190 m x 2 x 0.5 m = 190 m² @ $18.00 / m² =	$3,420.00	$9.00	$18.00
Shoulder Treatment Total:	$6,558.88	$17.26	$34.52
Surface Treatment			
Grind pavement to slope: 190 m x 5.4 m = 1026 m² @ $1.35 =	$1,385.10		$7.29
Bituminous Mix Gradation "E": 190 m x 5.4 m x 0.5 cm = 12.17 Mg @ $38.00 / M	$462.46		$2.43
Bituminous Mix Gradation "B": 190 m x 6.6 m x 4 cm = 119.03 Mg @ $29.90 / Mg	$3,559.00		$18.73
Bituminous Mix Gradation "C": 190 m x 6.6 m x 3 cm = 89.27 Mg @ $33.80 / Mg	$3,017.33		$15.88
Surface Treatment Total:	$8,423.89		$44.33
Experimental Section Total:	**$14,982.77**		**$78.85**

Control Section
Station 3+230 to 3+540

	Costs per:		
Shoulder Treatment	**Section**	**Meter**	**Section / Meter**
Shoulder rehabilitation (ditching): 190 m x 2 x 0.6 m = 228 m² @ $3.80 =	$866.40	$2.28	$4.56
Hot Recycled Pavement: 190 m x 2 x 0.6 m x 15 cm = 81.16 Mg @ $28.00 / Mg =	$2,272.48	$5.98	$11.96
Shoulder Treatment Total:	$3,138.88	$8.26	$16.52
Surface Treatment			
Grind pavement to slope: 190 m x 5.4 m = 1026 m² @ $1.35 =	$1,385.10		$7.29
Bituminous Mix Gradation "E": 190 m x 5.4 m x 0.5 cm = 12.17 Mg @ $38.00 / M	$462.46		$2.43
Bituminous Mix Gradation "B": 190 m x 6.6 m x 4 cm = 119.03 Mg @ $29.90 / Mg	$3,559.00		$18.73
Bituminous Mix Gradation "C": 190 m x 6.6 m x 3 cm = 89.27 Mg @ $33.80 / Mg	$3,017.33		$15.88
Surface Treatment Total:	$8,423.89		$44.33
Control Section Total:	**$11,562.77**		**$60.85**

TABLE 3

Falling Weight Deflectometer Tests

Benton - Clinton Project No. STP-8651(00)X

Section	Direction	Ave Shoulder Deflection (mils)	Ave Roadway Deflection (mils)	Shoulder vs Roadway Comparision		
				Difference (mils)	Difference (%)	1998 Data Difference (%)
Section 0	EBL	18.97	12.68	6.29	49.65%	228.46%
Maintenance	WBL	21.77	10.21	11.56	113.24%	142.52%
Mix	Section Ave	20.37	11.44	8.93	78.02%	178.82%
Section 1	EBL	12.11	10.04	2.07	20.62%	55.81%
300 mm ASCG	WBL	14.81	7.87	6.94	88.15%	71.84%
380 mm	Section Ave	13.46	8.96	4.51	50.30%	63.73%
Recycled Pavement						
Section 2A	EBL	13.73	8.48	5.25	61.95%	101.80%
300 mm ASCG	WBL	13.47	7.67	5.80	75.56%	82.93%
230 mm	Section Ave	13.60	8.07	5.52	68.42%	92.25%
Flowable Fill						
Section 2B	EBL	4.73	6.12	-1.39	-22.72%	N/A
530 mm						
Flowable Fill						
Section 3	EBL	7.82	6.38	1.44	22.49%	-2.63%
300 mm ASCG	WBL	10.83	6.88	3.94	57.30%	28.48%
230 mm of	Section Ave	9.32	6.63	2.69	40.54%	12.56%
25 mm						
Superpave						
Section 4	EBL	22.49	7.09	15.40	217.13%	271.45%
Heavy Overlay	WBL	25.72	7.19	18.53	257.53%	332.97%
	Section Ave	24.11	7.14	16.96	237.48%	301.45%

Veazie - Orono Project No. STP-6683(00)X

Section	Direction	Ave Shoulder Deflection (mils)	Ave Roadway Deflection (mils)	Shoulder vs Roadway Comparision		
				Difference (mils)	Difference (%)	1998 Data Difference (%)
Self Adhesive	EBL	N/A	N/A			
Mesh Section	WBL	N/A	N/A			
	Section Ave	N/A	N/A			
Control Section	EBL	N/A	N/A			
	WBL	N/A	N/A			
	Section Ave	N/A	N/A			

Lower deflection (mils) denotes stronger highways

Table 4

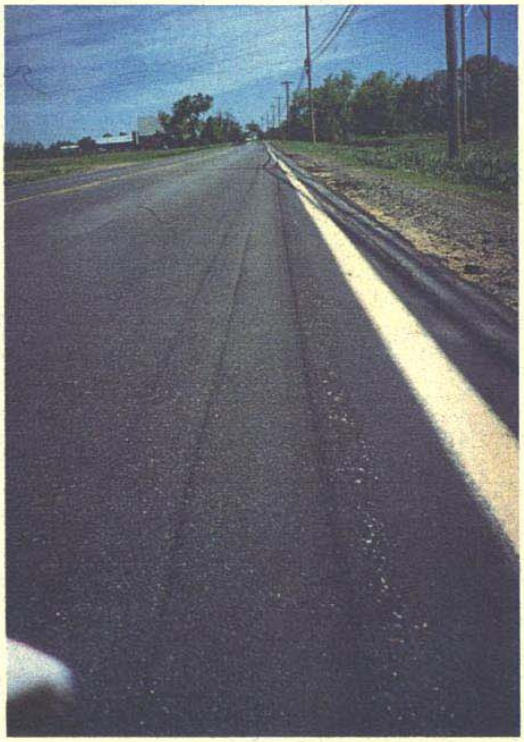
Pavement Condition Summary

Benton - Clinton Project No. STP-8651(00)X

	Rutting (%)			Centerline joint condition		Number of transverse cracks				
Section	< 6 mm	6 - 13 mm	> 13 mm	Ravel (%)	Separation (%)	Full width (across two lanes)	Half width (across one lane)	Between Wheelpaths	PCC edge related longitudinal cracking (%)	Shoulder elevation change (mm)
0	65	0.8	4	0	0	25	12	102	49.5	0
1	100	0	0	90	0	0	1	0	0.6	0
2A	100	0	0	83	0	1	0	0	0	0
2B	100	0	0	0	0	0	0	0	0	0
3	100	0	0	30	0	0	0	0	10.7	6
4	100	0	0	85	0	8	11	13	0.4	0

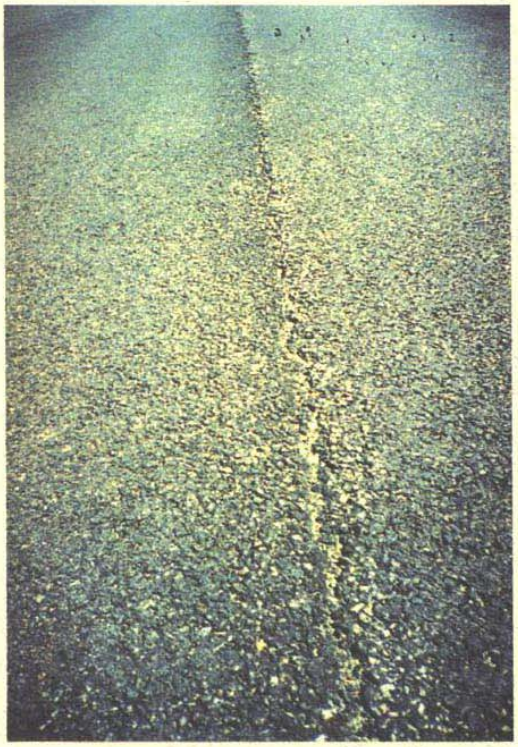
Veazie - Orono Project No. STP-6683(00)X

	Rutting (%)			Centerline joint condition		Number of transverse cracks				
Section	< 6 mm	6 - 13 mm	> 13 mm	Ravel (%)	Separation (%)	Full width (across two lanes)	Half width (across one lane)	Between Wheelpaths	PCC edge related longitudinal cracking (%)	Shoulder elevation change (mm)
SAM	100	0	0	0	0	2	2	2	2	0
Control	100	0	0	0	0	2	0	1	28	0



Section Ø wheel rut

Section 1 Centerline Joint

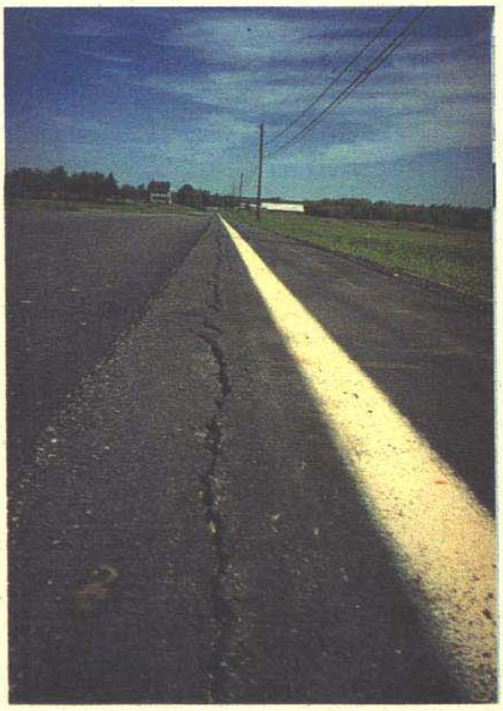


Section 2 Centerline Joint

Section 3 Centerline Joint

Section 3 Typical Shoulder Joint

Section 3 Longitudinal PCC Edge Related Cracking



Section 3 Longitudinal Crack Elevation Change

Section 4 Centerline Joint